

Transition roadmaps to phase-out fossil fuels from urban heating & cooling



Project Summary Activities, Results & Recommendations

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Project Summary

Context and objectives of the project

Heating and cooling is responsible for roughly 40% of the EU's final energy consumption, so transitioning it to energy efficient, renewable solutions is critical to bring EU countries and EU cities in line with their pledged climate neutrality and energy efficiency targets.

Given the long lifecycles of grid infrastructure ("city pipes" = district heating grid, gas grid and electricity grid) as well as of buildings, their envelopes and their heating systems, the planning of this transition must begin today. This urgency has been reinforced by the recently adopted EU Energy Efficiency Directive, which will oblige cities with more than 45,000 inhabitants to prepare heating & cooling plans. But how? What to do first? Which systems to adopt? How to govern this process? Due to the increased complexity of the energy system combined with technological uncertainties, a high level of knowledge and skills is required to plan a successful heating and cooling transition. Cities are often illequipped for this work; they lack capacity and skills as well as legal empowerment to act.

The EU Horizon 2020 project Decarb City Pipes 2050 showcased how local authorities can build the capacity to make progress in addressing this challenge. Seven cities – Bilbao, Bratislava, Dublin, Munich, Rotterdam, Vienna, and Winterthur – joined forces to learn from each other and elaborate innovative responses together. These cities – ranging from frontrunners to beginners – built up skills in the collection and use of data, and the design and deployment of planning tools and instruments and explored transition pathways suitable for their local challenges. They also identified technically and economically feasible technology options and built internal know-how on process and transition management.

In a participatory process within each city administration and in close cooperation with external local stakeholders (mostly utilities and grid operators), the cities developed tangible and actionable transition roadmaps to decarbonise heating and cooling in buildings by 2050 (or even earlier in the case of Munich, Rotterdam, Vienna, and Winterthur), taking up the challenge of phasing out (natural) gas and oil. In-depth peer-to-peer exchanges, cities and utilities shared knowledge to learn from each other's perspectives, stages of advancement and planning cultures.

In this process, cities were supported by two scientific partners and an international advisory board. In addition, Energy Cities, the European association of local authorities in energy transition, coordinated the dissemination of insights and results to other cities and stakeholders. Together, all consortium partners also advocated for the needed changes to current framework conditions at all levels (EU, national, regional).

Activities and key results

The work was structured into three decisive steps and related key results: (1) a common heating and cooling outlook, (2) taylored heating and cooling plans and (3) transition roadmaps.



Despite the challenges associated with the COVID-19 pandemic, Bilbao, Dublin, Munich, Rotterdam, Vienna, and Winterthur successfully established local working groups to discuss in detail local visions, outlooks for a climate neutral heating and cooling sector, and spatially differentiated heating and cooling plans as well as transition roadmaps. These local working groups included stakeholders from city administrations as well as utilities, grid operators (DSO), etc.

The first task of these local working groups was, with the support of the project's scientific partners, to elaborate a climate neutral **"Heating and Cooling Outlook"** (*by 2050 or earlier*). Assumptions about the future energy demand and future energy supply mix were discussed and agreed upon. Key learning in this context: the future availability and role of district heating (one central and interconnected grid or micro-grids for neighbourhoods) and of "renewable gases" (biogas or green hydrogen) is essential, as the answer to these questions has huge implications for infrastructure planning within cities. There was agreement among the partners that "green gases" will neither be available in sufficient quantities in time for heating decarbonisation nor will they be affordable for customers. Therefore, cities should not rely on the hope to simply replace natural gas by green gases and use existing gas infrastructure for zero-carbon heating.



FIGURE 2: VIENNA'S HEATING OUTLOOK (PUBLISHED IN VIENNA'S CLIMATE GUIDE, ADOPTED BY THE CITY COUNCIL IN 2022): PATHWAY FOR THE SWITCH FROM GAS AND OIL TOWARDS DISTRICT HEATING, HEAT PUMPS AND OTHER CLIMATE FRIENDLY ENERGY SYSTEMS.

Based on these insights, the cities aligned their quantitative vision of future demand with local supply conditions, considering issues such as "heat demand density", the availability of infrastructure and on-site energy potentials and energy generation capabilities.



FIGURE 3: DEVELOPMENT PROCESS FOR WINTERTHUR'S HEATING (AND COOLING) PLAN

This resulted in spatially differentiated **"Heating and Cooling Plans"** (with a "WHAT map" and ideally also a "WHEN map"), which have two main energy systems in common: (1) District heating grids to be created, expanded or densified in dense areas, and (2) heat pumps (in buildings or in micro-grids) for the less dense areas.

Het goedkoopste alternatief voor aardgas op buurtniveau voor bestaande bouw



FIGURE 4:

THE ROTTERDAM 'WHAT MAP' PRESENTS THE CHEAPEST ALTERNATIVE TO GAS FOR HEATING IN EXISTING BUILDINGS PER NEIGHBOURHOOD. IN BLUE AREAS, ELECTRIC HEATING USING HEAT PUMPS IS CHEAPER, WHEREAS IN RED AREAS, CONNECTION TO DISTRICT HEATING IS CHEAPER.

In the next step, the cities developed "**Transition Roadmaps**". These lay out instruments to be employed, actions, sub-targets and milestones, etc... With the formal adoption of these roadmaps in most of the cities, they set now the framework for the achievement of energy efficient, zero-carbon local H/C by 2050 (or earlier).

In the second half of the project, travel was once again possible and exchange and peer-topeer learning was supported by "study tours" during which relevant stakeholders of cities visited others and studied different H/C transition strategies in action, for example the district-oriented approaches of Rotterdam or the decommissioning of the gas grid in Winterthur or the decarbonisation of Munich's district heating with deep geothermal plants.

"Beginner cities" also learned from "frontrunner cities", like Winterthur, about the challenges cities encounter once the necessary legally binding framework for the phase out of oil and gas boilers is in place; topics such as how to organize the flow of information (data protection regulations form a hurdle), energy consultations for different stakeholder groups, the rapid conversion of administrative processes (scope and procedure of approvals), the legal handling of transitional solutions (approval of new fossil solutions with transitional contracts for x years), skills gaps etc. come to the fore at this stage.

Under the auspices of Energy Cities, the project reached out to a much wider group of cities, not least through the project's active online presence (e.g., website, newsletter, Twitter, etc.). Guidance for cities, stories from the seven cities as well as heating & cooling plans and roadmaps of the cities are available at the <u>project's website</u>.

Progress and impacts

In 2019, when the project proposal was conceived, there were still no European Green Deal, no 2050 climate neutrality target and no EU directives obliging larger cities to plan for heating. All of this is now enshrined in EU law. The cities participating in the Decarb City Pipes 2050 project undertook deliberations and planning processes that now, a few years later, need to be undertaken in many more European cities. Experiences, recommendations, tools etc. developed within this project may help many other cities to speed up their considerations, their planning, and their set-up of governance structures to local heating and cooling plans and the phase out the use of fossil fuels in buildings.

The project has underlined, that transition processes at city level require broad stakeholder cooperation, not least between the city, its grid operators and utilities, but also with civil society, etc... The composition of the local working groups and their subgroups (e.g. on technical, financial, legal questions) is crucial for their success and should correspond to local stakeholder constellations and framework conditions.

Between 2020 and 2023, the project empowered more than 240 public officers within the participating cities and more than 200 in other cities. Ultimately, it strived to motivate and support more than 80 cities to start the same roadmap process.

In addition, **more than 50 policies** from laws to funding guidelines and strategies, mostly at city level but also at regional or national level, were **improved or influenced** through activities and engagement of the consortium partners.

Anticipating the dynamics at European level, the project also developed a set of **ten key recommendations** to national governments and to the European Union.

The project succeeded to support several meetings at which the gas package was discussed by Members of the European Parliament and members of the European Commission and contributed to the final design of the directive calling for increased alignment of the network development plans for natural gas, hydrogen, and electricity, in particular also at the distribution grid level. Hydrogen is to be used primarily in sectors that are difficult to decarbonize. Municipal heating and cooling plans, which all cities with a population of over 45,000 must draw up in future, must also be taken into account when planning the grids. Gas distribution network operators must draw up plans for the decommissioning of networks if the implementation of municipal heating plans is expected to lead to a decline in demand for natural gas. At a press conference on the directive at the end of the trilogue, the directive's rapporteur in the European Parliament referred to the example set by cities in the Decarb City Pipes consortium as one of the factors that inspired the call for mandatory network planning for gas distribution.

Ten Recommendations to Superior Levels

The Decarb City Pipes 2050 project has formulated 10 key recommendations to superior levels (EU, Member States, provinces) that must be adopted to create a regulatory framework that will facilitate the acceleration of H/C transitions in European cities.

- 1 Require integrated planning of energy infrastructure at the municipal level. Decarbonised heating and cooling are impossible without closer integration of electricity and heat infrastructure planning. EU and national governments should make joint planning of energy generation and storage, and grid expansion for both, district heating and electricity, compulsory in municipalities. Grid operators and energy suppliers should be required to cooperate and commit to climate neutrality.
- 2 **Remove barriers to data collection.** Municipalities need granular data for heat planning and zoning, as the most cost-effective decarbonisation pathways depend on factors such as heating demand, the types of systems currently installed in households, etc. However, collecting this data is complicated under data protection regulations (GDPR). Cities require support to establish the legal basis for this data collection. National governments should also consider establishing heating databases to track the H/C transition at the national level.
- **Provide long-term support to build and retain the skilled in-house workforce required for successful H/C transitions.** This is mandated in Art. 25 of the EU Energy Efficiency Directive, on "Heating and cooling assessment and planning": "Member States shall support regional and local authorities to the utmost extent possible by any means, including financial support and technical support schemes." Municipalities need support to build capacity for technical heat planning, for law enforcement, for forming new actors and infrastructure, to provide energy advice to citizens, for organising participation formats, for undertaking communication campaigns, etc.
- Provide legal mechanisms to enforce communal energy zoning and heat planning. Energy planning is not a goal in itself – decarbonisation is! Cities do not always have direct control over all elements of their H/C infrastructure and expecting building owners and households to voluntarily connect to district heating systems or replace gas boilers with heat pumps has proven unrealistic. Cities need the right tools to enforce compliance with decarbonisation plans, which would also provide certainty about future heating systems, timelines, and the availability of subsidies.
- 5 **Restrict the use of or ban gas boilers (including 'hydrogen-ready' boilers).** Governments have been hesitant to ban gas boilers, to keep the option open to

switch to 'green gas' (biogas, hydrogen) in the future. Manufacturers have begun selling 'hydrogen-ready' boilers in anticipation of this switch. However, it has become obvious, and should be confirmed at the European level, that the availability of green gases will be limited until at least 2040, and that their use should be prioritised in hard-to-abate processes (e.g. cement and steel manufacturing). Therefore, green gases should not be viewed as an option for decarbonising H/C in buildings.

- 6 Linked to the above, **provide 'technology clarity' instead of misleading 'technology neutrality'.** Officially support preferred technologies and rule out unfeasible ones to de-risk investments in the H/C transition by building owners, utilities (esp. district heating) and distribution system operators (DSOs). This prevents delays in the transition as stakeholders wait for green gas and similar unfeasible solutions to become widely available.
- 7 Remove all legal obligations to connect buildings to gas networks. Instead, implement supportive regulation for the reduction of gas demand in large parts of the distribution networks and for the decommissioning of the gas distribution grid.
- 8 **Provide stable economic incentives.** Use prices, taxes, and subsidies over the long term (beyond election terms) to cushion investments costs for citizens, e.g. for heat pumps and electric stoves, prioritising but not limited to lowest-income households.
- 9 **Incentivise the exploitation of local heat potential.** This may include waste heat from industry or waste incineration, geothermal heat, etc. Provide financial support, remove legal barriers, and prioritise renewable heat infrastructure through spatial planning.
- Last but not least: Encourage heating system exchange in combination with renovation. Provide subsidies, create legal requirements, and use other means to ensure that any extensive renovations of existing buildings include disconnection from gas networks and connection to district heating or the installation of heat pumps.



FIGURE 5:

THE DECARB CITY PIPES 2050 CONSORTIUM IN WINTERTHUR IN 2022



DECARB CITY PIPES

https://decarbcitypipes2050.eu/



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